Sampling Episode Report
Holland America Oosterdam
Sampling Episode 6506

Chapter 3
Sample Collection Methodology

March 2006

3.0 SAMPLE COLLECTION

This section describes the sample collection and analysis methods and deviations from the ship-specific Sampling and Analysis Plan for Holland America Oosterdam (Oosterdam SAP; Appendix E). A more detailed explanation of the sampling methodologies, analytes and analytical methods, sampling frequency and duration, schedule, and logistics that were followed during sampling onboard the Oosterdam can be found in Section 3.0 of the Oosterdam SAP.

3.1 Pre-Sampling Activities

EPA performed an engineering ship visit to the Oosterdam on March 28, 2004. The Oosterdam SAP was prepared based on information collected during that ship visit and from subsequent follow-up communication with Holland America personnel. One week prior to the sampling episode, personnel conducted sampling setup activities onboard the Oosterdam, including loading sampling equipment and the onboard laboratory, inspecting the installed sampling ports, installing the strap-on ultrasonic flow meters, and installing and programming the automatic sampling machines.

3.2 Sample Collection and Analysis Methodology

In general, graywater and wastewater treatment residual samples were taken for one 24-hour period, while samples of the influents to and effluents from the treatment systems were taken for five consecutive 24-hour periods (see Tables 2-1 and 2-2). Various sample collection methods (described in Table 3-1) were used depending on the waste stream and analyte (see Table 3-2). Most samples were composited over each 24-hour sampling period or were single grab samples in a 24-hour period. However, multiple (1 to 3) grab samples per 24-hour period were collected for pathogen indicator analyses because these samples must be analyzed within 6 hours of collection (see Table 3-2). Table 3-3 describes the analyte groups and lists the analytical methods used.

Each time a grab or grab composite sample was taken, another separate sample was placed in a separate container to perform field measurements of pH, temperature, conductivity, salinity, turbidity, sulfide, and free and total chlorine. Temperature and pH were measured immediately at the sampling point, and the remaining parameters were measured at the sample staging area onboard. See Table 3-4 for equipment used for these measurements. Field measurements were used primarily to determine sample preservation requirements. Samples (other than those for field measurements) were preserved in accordance with procedures described in the Oosterdam SAP (Appendix E), with exceptions as noted in Section 3.6 and Table 3-5. Note that while Alaska and Federal regulations for cruise ship discharges include standards for total residual chlorine, the equipment used to measure residual chlorine onboard was not suitable for measuring low levels of chlorine (detection limit of 20 µg/L compared to a standard of 10 µg/L) and was subject to various interferences, such as from oxidized forms of manganese. Accordingly, the field measurements collected during this sampling episode should not be used to assess compliance with cruise ship discharge standards.

Flow data were collected from the strap-on flow meters installed by the sampling team. See Section 2.4 for descriptions of the flow meter locations and Figures 2-1 through 2-3 for their locations. The flow meters were programmed to record the instantaneous flow rate (m^3/min) and total flow (m^3) every five minutes.

3.3 Converting Solids Mass Units to Volume Units

The food pulper, screening solids (from both treatment systems), and waste biosludge samples had high solids contents; therefore, the results listed below were reported by the laboratories in mass units.

- Food pulper: classical pollutants (except settleable residue and BOD_5), metals, and volatile and semivolatile organics;
- Screening solids: classical pollutants, metals, and volatile and semivolatile organics; and
- Waste biosludge: classical pollutants (except available cyanide), metals, and volatile organics.

Solids contents for these samples ranged from 1.4% to 26%. To allow for direct comparison of these results to those of other wastewater samples, mass units for these samples were converted to volume units using the following equation and assuming a sample density of 1:

Amount (mass units) * (% solids/100) = Amount (volume units)

All data in this report pertaining to food pulper, screening solids, and waste biosludge samples are reported in volume units. The laboratory data packages, which are included in the Cruise Ship Rulemaking Record and available upon request, contain the original mass units results reported by the laboratories. Note that the analytical results for the incinerator ash sample were also reported in mass units. However, the incinerator ash results were not converted because the sample was 100% solids.

3.4 Quality Assurance/Quality Control

Duplicate samples were collected for quality assurance and quality control. Results for duplicate samples were averaged. See Section 5.2.3 and Tables 5-4 and 5-5 for details on duplicate sampling. Other field quality control samples prepared for this sampling episode include a trip blank and an equipment blank, which are discussed in Sections 5.2.1 and 5.2.2, respectively.

3.5 Interview with the Ship's Crew

The ship's crew was interviewed to obtain information regarding activities that impact wastewater generation. See Appendix C for details on these interviews and Section 4.2 for a summary.

3.6 Deviations from the Sampling and Analysis Plan

The sampling episode proceeded as specified in the Oosterdam SAP with the deviations described in Table 3-5.

Table 3-1

Sample Collection Method Descriptions, Holland America Oosterdam

Sample Collection Method	Description
Composite by Flow	Flow-weighted composite samples were collected using an automatic sampling machine interfaced with an installed strap-on ultrasonic flow meter (see Section 2.4). The flow meter signaled the automatic sampling machine to collect a 250-mL sample aliquot each time a fixed quantity of wastewater passed through the wastewater pipe. The number of composite sample aliquots collected per 24-hour sampling period ranged from approximately 30 to 70, depending on the total volume of sample required for planned analyses each sampling day. Sample aliquots were collected into a 10-L sample composite jar stored within the sampling machine. At the end of each 24-hour sampling period, the sample composite jar(s) were mixed and poured into individual sample bottles for analysis. Samples collected using the composite-by-flow method best represent a waste stream flowing through a pipe.
Composite by Time	Time-weighted composite samples were collected using an automatic sampling machine programmed to collect 250-mL sample aliquots at fixed time intervals. The programmed time interval differed by sampling point (see Table 3-2). The number of composite sample aliquots collected per 24-hour sampling period ranged from approximately 40 to 50, depending on the total volume of sample required for planned analyses. Sample aliquots are collected into a 10-L sample composite jar stored within the sampling machine. At the end of the 24-hour sampling period, the sample composite jar(s) were mixed and poured into individual sample bottles for analysis. The composite-by-time method was used when the composite-by-flow method was not feasible (see Table 3-2).
Grab	Grab samples were discrete samples collected directly into the sample bottles from the sample tap or through Teflon® tubing connected to the sample tap. Note that samples for pathogen indicator analyses were collected as grab samples (as opposed to composite samples) because they must be analyzed within a 6-hour holding time.
Grab Composite	Samples (1 to 4 per 24-hour sampling period) were manually collected as grab samples but composited either in the field or at the laboratory for a single analysis. The grab composite method was used when the composite-by flow or composite-by-time methods were not appropriate. **Volatile organics** - grab samples were collected directly into sample vials, which were filled completely to avoid loss of target analytes by volatilization. Grab samples for each 24-hour period for analysis of volatile organics were composited by the laboratory for a single analysis. **Total and available cyanide** - grab samples were chemically preserved as soon as possible to minimize interferences. The preserved total and available cyanide grab samples for each 24-hour period were composited onboard by the sampling team for a single analysis. **Hexane extractable material/silica-gel treated hexane extractable material (HEM/SGT-HEM)** - grab samples were collected directly into sample containers to avoid loss of HEM/SGT-HEM that might adhere to the interior of any interim sampling container (e.g., sample composite jar). The sampling team prepared composite HEM/SGT-HEM samples onboard for a single analysis per sampling period per day by filling approximately one-fourth (250-mL) of the sample containers when they collected each grab sample, resulting in 1-liter of sample in each container at the end of each sampling period.

Table 3-2

Sample Collection Methods and Analyte Groups Tested by Sampling Point, Holland America Oosterdam

Wastewater Name	Sampling Point # (a)(b)	Sample Collection Methods (c)	Analyte Groups Tested (d)	# of Days Sampled
Accommodations	SP-1	**Composite by flow** Twenty-four-hour sampling periods began at 0600 each day.	Classical pollutants: - BOD_5 - Settleable Residue - Group I - Group II Total and dissolved metals Semivolatile organics	1 (Day 3)
		Grab composite Collection times of the four subsamples in the composite can be found in Appendix A-3..	Classical pollutants: - HEM/SGT-HEM - Total and available cyanide Volatile organics	
		Grab One grab sample was taken. Appendix A-1 shows the collection time.	Pathogen Indicators	
Laundry	SP-2	**Composite by time** Automatic sampling machine was programmed to collect sample aliquots at 10-minute time intervals during the 24-hour sampling period. The sampling machine successfully collected sample aliquots only during the relatively few intervals during the 24-hour sampling period (0600 on 9/18/04 to 0600 on 9/19/04) when the laundry wastewater holding tank discharge pump turned on, thereby closely approximating a flow-weighted composite sample.	Classical pollutants: - BOD_5 - Settleable Residue - Group I - Group II Total and dissolved metals Semivolatile organics Dioxins and furans	1 (Day 1)
		Grab composite Collection times of the four subsamples in the composite can be found in Appendix A-3.	Classical pollutants: - HEM/SGT-HEM - Total and available cyanide Volatile organics	
		Grab One grab sample was taken. Appendix A-1 shows the collection time.	Pathogen indicators	

(a) See Figures 2-1 through 2-3 for simplified diagrams of the Oosterdam graywater and sewage CHT and treatment systems indicating the sampling point and flow meter locations.
(b) Two sampling point numbers indicate duplicate samples taken at this point for certain analytes. See Section 5.2.3 and Tables 5-4 and 5-5 for details on duplicate sampling.
(c) See Table 3-1 for descriptions of sample collection methods.
(d) See Table 3-3 for additional information regarding analytes tested and analytical methods used.

Table 3-2 (Continued)

Wastewater Name	Sampling Point # (a)(b)	Sample Collection Methods (c)	Analyte Groups Tested (d)	# of Days Sampled
Galley	SP-3	**Composite by time** Automatic sampling machine was programmed to collect 250-mL sample aliquots at 20-minute time intervals. The sampling machine successfully collected sample aliquots only during the relatively few intervals during the 24-hour sampling period (0600 on 9/19/04 to 0600 on 9/20/04) when crew galley wastewater flowed through the inlet pipe to the grease trap, thereby closely approximating a flow-weighted composite sample.	Classical pollutants: - BOD_5 - Settleable Residue - Group I - Group II Total and dissolved metals Semivolatile organics Pesticides	1 (Day 2)
		Grab composite Collection times of the four subsamples in the composite can be found in Appendix A-3.	Classical pollutants: - HEM/SGT-HEM - Total and available cyanide Volatile organics	
		Grab One grab sample was taken. Appendix A-1 shows the collection time.	Pathogen indicators	
Food Pulper, Centrifuge System	SP-5	**Grab** One grab sample was collected when the food pulper wastewater was drained from the centrifuge to the drain tank. See Appendix A-3 for the collection time.	Pathogen indicators Classical pollutants: - BOD_5 - Settleable Residue - Group I (except TDS and TSS) - Group II - Total and available cyanide Total and dissolved metals Volatile and semivolatile organics	1 (Day 5)

(a) See Figures 2-1 through 2-3 for simplified diagrams of the Oosterdam graywater and sewage CHT and treatment systems indicating the sampling point and flow meter locations.
(b) Two sampling point numbers indicate duplicate samples taken at this point for certain analytes. See Section 5.2.3 and Tables 5-4 and 5-5 for details on duplicate sampling.
(c) See Table 3-1 for descriptions of sample collection methods.
(d) See Table 3-3 for additional information regarding analytes tested and analytical methods used.

Table 3-2 (Continued)

Wastewater Name	Sampling Point # (a)(b)	Sample Collection Methods (c)	Analyte Groups Tested (d)	# of Days Sampled
Influent to ROCHEM Graywater Treatment System	SP-6	**Grab composite** Collection times for the four subsamples in the composites each day can be found in Appendix A-3.	Classical pollutants: - BOD_5 - Settleable Residue - Group I - Group II - HEM/SGT-HEM - Total and available cyanide Total and dissolved metals Volatile and semivolatile organics	5
		Grab Two grab samples were taken per sampling day. Results presented in Table 4-2 are an average for each sampling day (calculation used detection limits for nondetected results). Results and collection times for each grab sample are presented in Appendix A-1.	Pathogen indicators	
Influent to UV Disinfection part of ROCHEM Graywater Treatment System	SP-7	**Grab** Three grab samples were taken per sampling day. Results presented in Table 4-3 are an average for each sampling day (calculation used detection limits for nondetected results). Results and collection times for each grab sample are presented in Appendix A-1.	Pathogen indicators	5
Effluent from ROCHEM Graywater Treatment System	SP-8/9	**Composite by flow (Days 1 through 3)** Twenty-four-hour sampling periods began at 0600 each day. **Grab composite (Days 4 and 5)** Collection times of the four subsamples in the composites each day can be found in Appendix A-3.	Classical pollutants: - BOD_5 - Settleable Residue - Group I - Group II Total and dissolved metals Semivolatile organics	5
		Grab composite Collection times of the four subsamples in the composites each day can be found in Appendix A-3.	Classical pollutants: - HEM/SGT-HEM - Total and available cyanide Volatile organics	
		Grab Three grab samples were taken per sampling day. Results presented in Table 4-4 are an average for each sampling day (calculation used detection limits for nondetected results). Results and collection times for each grab sample are presented in Appendix A-1.	Pathogen indicators	
Incinerator Ash	SP-10	**Grab** One grab sample was taken. Appendix A-3 shows the collection time.	Total metals Semivolatile organics Dioxins and furans	1 (Day 5)

(a) See Figures 2-1 through 2-3 for simplified diagrams of the Oosterdam graywater and sewage CHT and treatment systems indicating the sampling point and flow meter locations.
(b) Two sampling point numbers indicate duplicate samples taken at this point for certain analytes. See Section 5.2.3 and Tables 5-4 and 5-5 for details on duplicate sampling.
(c) See Table 3-1 for descriptions of sample collection methods.
(d) See Table 3-3 for additional information regarding analytes tested and analytical methods used.

Table 3-2 (Continued)

Wastewater Name	Sampling Point # (a)(b)	Sample Collection Methods (c)	Analyte Groups Tested (d)	# of Days Sampled
Influent to ROCHEM Sewage/Graywater Treatment System	SP-11	**Composite by flow** Twenty-four-hour sampling periods began at 0600 each day.	Classical pollutants: - BOD_5 - Settleable Residue - Group I - Group II Total and dissolved metals Semivolatile organics Pesticides Polychlorinated biphenyls	5
		Grab composite Collection times of the four subsamples in the composites each day can be found in Appendix A-3.	Classical pollutants: - HEM/SGT-HEM - Total and available cyanide Volatile organics	
		Grab Two grab samples were taken per sampling day. Results presented in Table 4-7 are an average for each sampling day. Results and collection times for each grab sample are presented in Appendix A-1.	Pathogen indicators	
Influent to UV Disinfection part of ROCHEM Sewage/Graywater Treatment System	SP-12	**Grab** Three grab samples were taken per sampling day. Results presented in Table 4-8 are an average for each sampling day (calculation used detection limits for nondetected results). Results and collection times for each grab sample are presented in Appendix A-1.	Pathogen indicators	5

(a) See Figures 2-1 through 2-3 for simplified diagrams of the Oosterdam graywater and sewage CHT and treatment systems indicating the sampling point and flow meter locations.
(b) Two sampling point numbers indicate duplicate samples taken at this point for certain analytes. See Section 5.2.3 and Tables 5-4 and 5-5 for details on duplicate sampling.
(c) See Table 3-1 for descriptions of sample collection methods.
(d) See Table 3-3 for additional information regarding analytes tested and analytical methods used.

Table 3-2 (Continued)

Wastewater Name	Sampling Point # (a)(b)	Sample Collection Methods (c)	Analyte Groups Tested (d)	# of Days Sampled
Effluent from ROCHEM Sewage/Graywater Treatment System	SP-13/14	**Composite by flow** Twenty-four-hour sampling periods began at 0600 each day.	Classical pollutants: - BOD_5 - Settleable Residue - Group I - Group II Total and dissolved metals Semivolatile organics	5
		Grab composite Collection times of the four subsamples in the composites each day can be found in Appendix A-3.	Classical pollutants: - HEM/SGT-HEM - Total and available cyanide Volatile organics	
		Grab Three grab samples were taken per sampling day. Results presented in Table 4-9 are an average for each sampling day (calculation used detection limits for nondetected results). Results and collection times for each grab sample are presented in Appendix A-1.	Pathogen indicators	
Graywater Screening Solids	SP-15	**Grab** One grab sample was taken. Appendix A-3 shows the collection time.	Classical pollutants: - Group I - Group II - Total and available cyanide Total metals Volatile and semivolatile organics	1 (Day 5)

(a) See Figures 2-1 through 2-3 for simplified diagrams of the Oosterdam graywater and sewage CHT and treatment systems indicating the sampling point and flow meter locations.
(b) Two sampling point numbers indicate duplicate samples taken at this point for certain analytes. See Section 5.2.3 and Tables 5-4 and 5-5 for details on duplicate sampling.
(c) See Table 3-1 for descriptions of sample collection methods.
(d) See Table 3-3 for additional information regarding analytes tested and analytical methods used.

Table 3-2 (Continued)

Wastewater Name	Sampling Point # (a)(b)	Sample Collection Methods (c)	Analyte Groups Tested (d)	# of Days Sampled
Final Combined Treated Effluent	SP-16	**Composite by flow** Twenty-four-hour sampling periods began at 0600 each day.	Classical pollutants: - BOD_5 - Settleable Residue - Group I - Group II Total and dissolved metals Semivolatile organics	5
		Grab composite Collection times of the four subsamples in the composites each day can be found in Appendix A-3.	Classical pollutants: - HEM/SGT-HEM - Total and available cyanide Volatile organics	
		Grab The number of grab samples taken per sampling day were as follows: 2, 3, 3, 3, 3. Results presented in Table 4-12 are an average for each sampling day (calculation used detection limits for nondetected results). Results and collection times for each grab sample are presented in Appendix A-1.	Pathogen indicators	
Source Water	SP-17	**Grab** One grab sample was taken. Appendix A-3 shows the collection time.	Pathogen indicators Classical pollutants: - BOD_5 - Settleable Residue - Group I - Group II - Total and available cyanide Total and dissolve metals Volatile and semivolatile organics	1 (Day 2)
Trip Blank	SP-18	**Grab sample** One grab sample was taken. High performance liquid chromatography (HPLC) water was poured directly into sample vials in the contractor's Chantilly, VA sampling room and shipped to the Oosterdam. The trip blank was shipped back (unopened) to the laboratory along with the collected samples.	Volatile organics	1 (Day 4)
Equipment Blank	SP-19	**Grab sample** One grab sample was taken. The equipment blank consisted of HPLC water pumped through the automatic sampling machine and tubing and directly into the sample bottles.	Total and dissolved metals Semivolatile organics	1 (Day 2)

(a) See Figures 2-1 through 2-3 for simplified diagrams of the Oosterdam graywater and sewage CHT and treatment systems indicating the sampling point and flow meter locations.
(b) Two sampling point numbers indicate duplicate samples taken at this point for certain analytes. See Section 5.2.3 and Tables 5-4 and 5-5 for details on duplicate sampling.
(c) See Table 3-1 for descriptions of sample collection methods.
(d) See Table 3-3 for additional information regarding analytes tested and analytical methods used.

Table 3-2 (Continued)

Wastewater Name	Sampling Point # (a)(b)	Sample Collection Methods (c)	Analyte Groups Tested (d)	# of Days Sampled
Sewage/Graywater Screening Solids	SP-20	**Grab** One grab sample was taken. Appendix A-3 shows the collection time.	Classical pollutants: - Group I - Group II - Total and available cyanide Total metals Volatile and semivolatile organics	1 (Day 3)
Sewage/Graywater Waste Biosludge	SP-21	**Grab** One grab sample was taken. Appendix A-3 shows the collection time.	Classical pollutants: - Group I - Group II - Total and available cyanide Total metals Volatile and semivolatile organics	1 (Day 3)

(a) See Figures 2-1 through 2-3 for simplified diagrams of the Oosterdam graywater and sewage CHT and treatment systems indicating the sampling point and flow meter locations.
(b) Two sampling point numbers indicate duplicate samples taken at this point for certain analytes. See Section 5.2.3 and Tables 5-4 and 5-5 for details on duplicate sampling.
(c) See Table 3-1 for descriptions of sample collection methods.
(d) See Table 3-3 for additional information regarding analytes tested and analytical methods used.

Table 3-3

Analytes and Analytical Methods, Holland America Oosterdam

Analyte Group	Analytes	Analytical Method Number
Pathogen Indicators	*E. coli*	EPA 9223B
	Enterococci	ASTM D6503-99
	Fecal coliform	EPA 9222D
Classical Pollutants	Biochemical oxygen demand (BOD_5)	EPA 405.1
	Settleable Residue (SS)	EPA 160.5
	Group I: - Total suspended solids (TSS) - Total dissolved solids (TDS) - Sulfate - Chloride - Alkalinity	 EPA 160.2 EPA 160.1 EPA 375.4 EPA 325.3 EPA 310.1
	Group II: - Total organic carbon (TOC) - Chemical oxygen demand (COD) - Ammonia as nitrogen - Nitrate/nitrite as nitrogen - Total Kjeldahl nitrogen - Total phosphorus	 EPA 415.1, Lloyd Kahn (“solids” samples) EPA 410.4 EPA 350.3 EPA 353.1 EPA 351.3 EPA 365.2
	Oil and grease measured as hexane extractable material and petroleum hydrocarbons measured as silica-gel treated hexane extractable material (HEM/SGT-HEM)	EPA 1664A
	Cyanide: - Total cyanide - Available cyanide	 EPA 335.2 EPA 1677
	Hardness	EPA 2340B
Total and Dissolved Metals	See Appendix A-2 for a complete list of total and dissolved metals analyzed.	EPA 200.7, EPA 200.9 (thallium), EPA 245.1(mercury “liquid” samples), 245.5 (mercury “solids” samples)
Volatile and Semivolatile Organics	See Appendix A-2 for a complete list of volatile and semivolatile organics analyzed.	EPA 624 EPA 625
Pesticides	See Appendix A-2 for a complete list of organohalide and organophosphorus pesticides.	EPA 1656A EPA 1657A
Polychlorinated Biphenyls (PCBs)	See Appendix A-2 for a complete list of PCBs analyzed.	EPA 1668A
Dioxins and Furans	See Appendix A-2 for a complete list of dioxins and furans analyzed.	EPA 1613B

Table 3-4

Field Measurement Equipment, Holland America Oosterdam

Parameter	Measured by:
pH	Four-color pH paper
Temperature	Alcohol thermometer
Conductivity and Salinity	Portable conductivity/salinity meter (YSI Model 30)
Turbidity	Pocket turbidimeter (Hach Cat. No. 52600-00)
Sulfide	Colorimeter (Hach DR 890)
Free and Total Chlorine	Pocket colorimeter (Hach Cat. No. 46700-00)

Table 3-5

Deviations from the Sampling and Analysis Plan, Holland America Oosterdam

Deviation	Description
Pathogen Indicators Laboratory Duplicates	For 5% of the pathogen indicators samples, duplicate 100-mL sample volumes were taken with the intention that the laboratory would composite the 100-mL sample volumes and then analyze duplicate samples from each composite sample to evaluate laboratory precision (i.e., laboratory duplicates). However, the laboratory did not prepare composites, but instead analyzed each of the 100-mL sample volumes individually. Accordingly, the results obtained from these analyses are field duplicate samples, not laboratory duplicates, and are presented and handled as such in this report. See Section 5.2.3 and Table 5-5 for details on duplicate sampling for pathogen indicators.
Laundry Wastewater (SP-2), Composite Samples	The strap-on flow meter set-up and calibration procedure was unsuccessful at the laundry wastewater sampling point (on the outlet pipe from the laundry wastewater holding tank), most likely due to close proximity to pumps and other sources of turbulence such as nearby machinery. As a result, flow data could not be collected at this sampling point. In addition, the flow meter could not be used to initiate collection of flow-weighted composite samples at SP-2 as described in the Oosterdam SAP. As an alternative sampling methodology, the automatic sampling machine was programmed to collect a time-weighted composite sample as described in Table 3-2. EPA concluded that the collected samples were representative of laundry wastewater as generated onboard the Oosterdam.
Food Pulper Wastewater, Vacuum System (SP-4)	Samples of food pulper wastewater generated by the vacuum food pulper system could not be collected because this food pulping system was not operating during the sampling episode.
Influent to ROCHEM Graywater Treatment System (SP-6), Composite Samples	The installed strap-on flow meter could not be used to trigger collection of flow-weighted composite samples at this sampling point because high wastewater pressure caused continuous collection of sample when the sample tap was left open. As an alternative sampling methodology, the sampling team collected manual grab composite samples as described in Table 3-2. EPA concluded that the collected samples were representative of the influent to the graywater treatment system onboard the Oosterdam.
Effluent from ROCHEM Graywater Treatment System (SP-8/9), Composite Samples	At the end of Day 3, high wastewater pressure caused the installed strap-on flow meter to lose signal strength. Repeated attempts to run the flow meter set-up and calibration procedures were unsuccessful. As a result, flow data could not be collected at this sampling point for Days 4 and 5. In addition, the flow meter could not be used to initiate collection of flow-weighted composite samples at SP-8/9 on Days 4 and 5. As an alternative sampling methodology, the sampling team collected manual grab composite samples on these days as described in Table 3-2. EPA concluded that the collected samples were representative of the effluent from the graywater treatment system onboard the Oosterdam.
Final Combined Treated Effluent (SP16), Composite and Grab Samples	Composite by flow sampling at SP-16 was suspended on Day 1 from 0600 to 1800 because overboard discharge was suspended while the ship was in Washington waters, and on Day 4 from 1000 to 1430 because overboard discharge was suspended while the ship cruised Hubbard Glacier. (The flow meter that controlled composite by flow sample collection was located on the overboard discharge pipe, but during this time the effluent was diverted to double-bottom holding tanks.) On Day 1, only two of the planned grab and grab composite samples were collected as the sample tap was also located downstream of the valve that diverts the combined treated effluent to the double-bottom holding tanks. See Appendix A-1 for the sample collection times. Grab and grab composite sample collection times on Day 4 were not impacted by the suspended discharge.

Table 3-5 (Continued)

Deviation	Description
Combined Graywater and Sewage/Graywater Treatment System Waste Sludge (planned SP-15)	The Oosterdam SAP inaccurately described wastewater treatment residuals from the graywater and sewage/graywater treatment systems as being commingled inline as they are pumped to storage in the double-bottom holding tank. Instead, the graywater screening solids are collected manually and incinerated onboard while the sewage/graywater screening solids and waste biosludge are pumped to storage at different times and are generally not commingled until combined in the double-bottom holding tank.. Accordingly, there was no means of collecting a single sample of combined wastewater treatment residuals (planned SP-15) as described in the Oosterdam SAP. As a result, samples of each of the three treatment residuals (graywater screening solids (SP-15), sewage/graywater screening solids (SP-20), and waste biosludge (SP-21) were collected separately. See Table 2-2 for descriptions of the treatment residuals and their sampling point locations, and Table 3-2 for their sampling methodologies.
Volatile Organics Preservation	Free chlorine was detected in the pre-sampling field tests at all sampling points. Based on these results, the sampling team prepreserved all volatile organics sample vials with sodium thiosulfate rather than waiting to determine preservation requirements based on the free chlorine field test results. Free chlorine was generally detected in grab samples collected throughout the sampling episode. (Sample vials were also prepreserved with hydrochloric acid to control biological activity as discussed in the Oosterdam SAP.)
Analytical Methods	EPA-contracted laboratories substituted comparable EPA analytical methods for certain analytes. Table 3-3 lists the actual analytical methods used by the laboratories. Note that while the Oosterdam SAP correctly listed EPA Methods 624 and 625 as the planned methods for analyzing volatile and semivolatile organics, respectively, Appendix E of the Oosterdam SAP mistakenly listed the target analytes for EPA Methods 1624 and 1625. Appendix A-2 of this report presents the actual list of target volatile and semivolatile organics.
Sampling Schedule	The sampling team adjusted the sampling schedule in Appendix C of the Oosterdam SAP to accommodate sampling logistics and ship operations. Refer to Appendix A-3 of this report for actual samples collected and sample collection dates/times.
Food Pulper Wastewater, Centrifuge System (SP-5), Analyte Groups Tested	Analyses for hardness, hexane extractable material (HEM), silica-gel treated hexane extractable material (SGT-HEM), total dissolved solids (TDS), total suspended solids, and dissolved metals were not performed due to the high solids content in the sample.